

WHAT IS CLAIMED IS:

1. A method for forming a temperature controlled railway car comprising:

forming a railway car underframe having a  
5 generally rectangular perimeter defined in part by a first end, a second end and a pair of opposite sides spaced from each other and extending from the first end to the second end;

forming a pair of side wall assemblies and a  
10 pair of end wall assemblies with each side wall assembly and each end wall assembly having an exterior metal surface and an interior surface of fiber reinforced material with foam insulation bonded therebetween;

attaching a first side wall assembly with one  
15 side of the railway car underframe;

attaching a second side wall assembly with the other side of the railway car underframe;

attaching a primary floor to the railway car underframe;

20 attaching a first end wall assembly with the first end of the railway car underframe;

attaching a second end wall assembly with the second end of the railway car underframe;

attaching a roof assembly to the side wall  
25 assemblies and the end wall assemblies opposite from the primary floor;

applying insulating foam to respective joints formed between the end wall assemblies and the side wall assemblies, the primary floor and the side wall  
30 assemblies and the end wall assemblies, and the roof

assembly and the end wall assemblies and the side assemblies;

attaching a respective door assembly with an opening formed in each of the side wall assemblies to

5 control access to the railway car; and

installing a secondary floor on the primary floor opposite from the railway car underframe.

2. The method of Claim 1 further comprising:

10 forming a respective top chord for each side wall assembly;

forming a respective side sill assembly for each side wall assembly; and

15 attaching a plurality of metal sheets with the respective top chord and the respective side sill assembly to form a generally smooth, exterior metal surface for each side wall assembly.

3. The method of Claim 1 further comprising:

20 forming a respective top plate for each end wall assembly;

forming at least a portion of a respective end sill assembly for each end wall assembly; and

25 attaching a plurality of metal sheets with the respective top plate and respective portion of the end sill assembly to form a generally smooth, exterior metal surface for each end wall assembly.

4. The method of Claim 1 further comprising:  
forming a top chord for each side wall  
assembly;  
forming a side sill assembly for each side wall  
5 assembly;  
attaching a plurality of support posts with the  
respective side sill assembly and top chord;  
attaching a plurality of metal sheets with the  
top chord, support posts and side sill assembly to form  
10 an exterior metal surface for the respective side wall  
assembly;  
attaching a layer of fiber reinforced material  
with the support posts opposite from the metal sheets to  
form an interior surface for the respective side wall  
15 assembly;  
injecting liquid insulating foam into void  
spaces formed between the metal sheets, the support posts  
and the layer of fiber reinforced material;  
applying heat to the liquid insulating foam to  
20 form solid foam insulation with bonds between adjacent  
portions of the metal sheets, support posts and fiber  
reinforced material; and  
pressing the layer of fiber reinforced material  
and liquid insulating foam to maintain desired dimensions  
25 of the side wall assembly during formation of the solid  
foam insulation.

5. The method of Claim 1 further comprising:  
forming a top plate for each end wall assembly;  
forming at least a portion of an end sill  
assembly for each end wall assembly;

5           attaching a first edge plate and a second edge  
plate with respective ends of the top plate and the  
portion of the end sill assembly;

          attaching a plurality of end beams spaced from  
each other with a first end of each end beam attached to  
10       a respective portion of the first edge plate and a second  
end of each end beam attached to a respective portion of  
the second edge plate;

          attaching a plurality of metal sheets with the  
top plate, end beams and the portion of the end sill  
15       assembly to form an exterior metal surface for the  
respective end wall assembly;

          attaching a layer of fiber reinforced material  
with the end beams opposite from the metal sheets to form  
an interior surface for the respective end wall assembly;

20       injecting liquid insulating foam into void  
spaces between the metal sheets, the end beams and the  
layer of fiber reinforced material;

          applying heat to the liquid insulating foam to  
form solid foam insulation with bonds between adjacent  
25       portions of the metal sheets, end beams and fiber  
reinforced material; and

          pressing the layer of fiber reinforced material  
and the liquid insulating foam to maintain desired  
dimensions of the end wall assembly during formation of  
30       the solid foam insulation.

6. The method of Claim 1 further comprising:  
forming each side wall assembly with a  
plurality of metal sheets having an interior surface and  
an exterior surface;

5           attaching support posts with the interior  
surface of the metal sheets and the respective side sill  
assembly;

          attaching a layer of ballistic resistant fabric  
with the support posts opposite from the metal sheets to  
10       define in part void spaces between the interior surface  
of the metal sheets, the associated support posts and  
adjacent portions of the layer of fiber reinforced  
material;

          placing the side wall assembly in a press;  
15       injecting liquid insulating foam into the void  
spaces associated with each side wall assembly; and

          applying heat and pressure to the insulating  
foam to form solid foam insulation with bonds between the  
interior surfaces of the metal sheets, adjacent portions  
20       of the support posts and the layer of ballistic resistant  
fabric.

7. The method of Claim 6 further comprising  
placing an injection block with openings extending  
therethrough adjacent to the void spaces for use in  
injecting the liquid insulating foam into the respective  
5 void spaces.

8. The method of Claim 6 further comprising  
preheating each side wall assembly prior to placing the  
side wall assembly in the press.  
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9. The method of Claim 1 further comprising:  
forming each end wall assembly with a plurality  
of metal sheets having an interior surface and an  
exterior surface;  
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attaching end beams with the interior surfaces  
of the metal sheets;

attaching a layer of ballistic resistant  
material with the support posts opposite from the metal  
sheets to define in part void spaces between the interior  
20 surfaces of the metal sheets, the associated end beams  
and adjacent portions of the layer of ballistic resistant  
fabric;

placing the end wall assembly in a press;  
injecting liquid insulating foam into the void  
25 spaces associated with each end wall assembly; and

applying heat and pressure to the insulating  
foam to form solid foam insulation with bonds between the  
interior surface of the metal sheets, adjacent portions  
of the support posts and the layer of ballistic resistant  
30 fabric.



11. A method for forming an insulated railway car comprising:

forming a railway car underframe having a generally elongated, rectangular perimeter defined in part by a first end and a second end and a first side and a second side spaced from each other and extending longitudinally from the first end to the second end;

forming a pair of side wall assemblies and a pair of end wall assemblies with each end wall assembly and each side wall assembly respectively formed from a plurality of metal sheets having respective exterior surfaces and interior surfaces;

attaching a plurality of support posts spaced from each other with the interior surfaces of the metal sheets associated with each side wall assembly extending between a respective side sill assembly and a respective top chord;

attaching a plurality of end beams spaced from each other with the interior surfaces of the metal sheets associated with each end wall assembly;

attaching respective isolators to each support post and each end beam opposite from the attached metal sheets;

placing layers of fiber reinforced plastic on the isolators to form respective interior surfaces for the side wall assemblies and the end wall assemblies;

placing liquid insulating foam within void spaces formed between the metal sheets, support posts, end beams and layers of fiber reinforced plastic;



bonding resulting foam insulation with the interior surfaces of the metal sheets, adjacent support posts, adjacent end beams and adjacent portions of the fiber reinforced plastic;

5               coupling the side sill assembly of each side wall assembly with the railway car underframe; and

              coupling the portion of the end sill assembly of each end wall assembly with the railway car underframe.

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12. The method of Claim 11 further comprising attaching respective pieces of trim molding with flexible joints formed between the side wall assemblies and the end wall assemblies.

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13. A method of forming a side wall assembly  
for a composite box structure comprising:

attaching a plurality of support posts with one  
side of a plurality of metal sheets;

5        attaching at least one layer of fiber  
reinforced material with the support posts opposite from  
the metal sheets to form a plurality of void spaces  
between the metal sheets, the support posts and the layer  
of fiber reinforced material;

10        placing the side wall assembly in a foam press  
with the side wall assembly tilted at an angle;

      injecting liquid insulating foam into the  
respective void spaces; and

15        applying pressure and heat to the liquid  
insulating foam to form solid foam insulation having  
bonds with the metal sheets, adjacent support posts and  
adjacent portions of the fiber reinforced material.

14. The method of Claim 13 further comprising:

20        attaching a side sill assembly with one end of  
each support post and one edge of the metal sheets;

      attaching a top chord with an opposite edge of  
the metal sheets and an opposite end of each support  
post;

25        inserting an injection block having a plurality  
of holes extending therethrough into respective void  
spaces adjacent to the top chord; and

30        injecting the liquid insulating foam into the  
associated void spaces through the holes in the injection  
block.

15. The method of Claim 13 further comprising placing the side wall assembly in the foam press with the side wall assembly tilted at an angle between approximately eight degrees and twelve degrees.

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16. A method of forming an end wall assembly  
for a composite box structure comprising:

attaching a plurality of end beams with one  
side of a plurality of metal sheets;

5 attaching at least one layer of fiber  
reinforced material with the end beams opposite from the  
metal sheets to form a plurality of void spaces between  
the metal sheets, the support posts and the layer of  
fiber reinforced material;

10 placing the end wall assembly in a foam press  
with the end wall assembly tilted at an angle;

injecting liquid insulating foam into the  
respective void spaces; and

15 applying pressure and heat to the liquid  
insulating foam to form solid foam insulation having  
bonds with the metal sheets, adjacent end beams and  
adjacent portions of the fiber reinforced material.

17. The method of Claim 16 further comprising:

20 attaching at least a portion of an end sill  
assembly with one edge of the metal sheets; and

attaching a top plate with an opposite edge of  
the metal sheets.

25 18. The method of Claim 16 further comprising  
placing the end wall assembly in the foam press with the  
end wall assembly tilted at an angle between  
approximately eight degrees and twelve degrees.

19. A method of forming an insulated railway car comprising:

forming a railway car underframe with a center sill and a pair of body bolsters extending laterally

5 therefrom and spaced respectively from a first end and a second end of the center sill, a first railway truck proximate one of the body bolsters, a second railway truck proximate the other body bolster, and a plurality of cross bearers and cross ties spaced from each other  
10 and extending generally parallel with the center sill;

placing a plurality of longitudinal stringers on the cross bearers and cross ties with the longitudinal stringers spaced from each other and extending generally parallel with the center sill whereby the longitudinal  
15 stringers, the cross bearers and the cross ties cooperate with each other to form a generally elongated, rectangular configuration;

forming a pair of side wall assemblies with each side wall assembly having a respective side sill  
20 assembly formed an integral component thereof;

forming a pair of end wall assemblies with each end wall assembly having a respective end sill assembly formed as an integral component thereof;

attaching one of the side wall assemblies with  
25 the railway car underframe by forming a plurality of mechanical couplings between the associated side sill assembly and respective ends of the cross bearers and cross ties;

attaching the other side wall assembly with the  
30 railway car underframe by forming a plurality of

mechanical couplings between the associated side sill assembly and respective ends of the cross bearers and cross ties;

attaching one of the end wall assemblies with  
5 one end of the railway car underframe by forming a plurality of mechanical couplings between the railway car underframe and the respective end sill assembly; and

attaching the other end wall assembly with the  
other end of the railway car underframe by forming a  
10 plurality of mechanical coupling between the railway car underframe and the respective end sill assembly.

20. The method of Claim 19 comprising:  
forming each side sill assembly with a  
15 generally J shaped cross section; and  
forming a respective support member on an interior surface of each side sill assembly with the support member extending longitudinally from proximate one end of the side sill assembly to proximate an  
20 opposite end of the side sill assembly.

21. A manufacturing facility for use in assembling a railway car having a composite box structure mounted on and attached to a railway car underframe, the manufacturing assembly having at least a first assembly  
5 line comprising:

a first station for attaching a pair of side wall assemblies with the railway car underframe;

a second station for applying a primary floor with the railway car underframe;

10 a third station for attaching a pair of end wall assemblies with the railway car underframe;

a fourth station for completing attachment of the side wall assemblies and the end wall assemblies with the primary floor and the railway car underframe;

15 a fifth station for applying a roof assembly to the side wall assemblies and the end wall assemblies opposite from the primary floor; and

a sixth station for hanging doors on respective openings formed in each side wall assembly.

20 22. The manufacturing facility of Claim 21 including a second assembly line comprising:

a first station for respectively attaching body bolsters adjacent to opposite ends of a center sill;

25 a second station for attaching cross bearers and longitudinal stringers with the center sill; and

a third station for attaching railway car trucks with the center sill adjacent to the body bolsters.

23. The manufacturing facility of Claim 21  
including a second assembly line comprising:

a first station to form a side sill assembly;

a second station to form a top chord;

5 a third station to attach support posts spaced  
from each other and coupled with the top chord and the  
side sill assembly;

a fourth station to attach metal sheets with an  
exterior of the top chord, side sill assembly and support  
10 posts; and

a fifth station for applying a layer of fiber  
reinforced material with the support posts opposite from  
the metal sheets.

15 24. The manufacturing facility of Claim 21  
including a second assembly line comprising:

a first station to form a top plate;

a second station to form an end sill assembly;

20 a third station to attach end beams spaced from  
each other and coupled with a first edge plate and a  
second edge plate;

a fourth station to attach a plurality of metal  
sheets with an exterior of the end frame assembly; and

25 a fifth station to attach a layer of fiber  
reinforced material with the end beams opposite from the  
metal sheets.



25. The manufacturing facility of Claim 21  
having a second assembly line comprising:

a first station for washing interior surfaces  
of the side wall assembly or the end wall assembly;

5 a second station for drying the end wall  
assembly or the side wall assembly;

a third station for preheating the end wall  
assembly or the side wall assembly;

10 a fourth station for injecting liquid  
insulating foam and applying heat and pressure to form  
solid foam insulation in the respective side wall  
assembly or the end wall assembly; and

a fifth station to complete the end wall  
assembly or side wall assembly.

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26. A method for forming a side wall assembly comprising:

forming a side sill assembly and a top chord;  
installing support posts and door posts between

5 the top chord and the side sill assembly;

welding the support posts and door posts with  
the top chord and the side sill assembly to form a side  
wall frame having an opening for a door;

10 attaching metal sheets to an exterior of the  
side wall frame;

welding portions of the metal sheets with  
adjacent portions of the side wall frame;

cleaning interior surfaces of the metal sheets  
and the side wall frame;

15 attaching a strip of insulating material with  
the support posts opposite from the metal sheets;

attaching at least one layer of fiber  
reinforced material with the strips of insulating  
material to form an interior surface of the side wall

20 assembly;

preheating the side wall assembly;

injecting liquid insulating foam into the side  
wall assembly between the metal sheets and the layer of  
fiber reinforced material; and

25 heating and pressing the liquid insulating foam  
to form solid foam insulation bonded with interior  
surfaces of the metal sheets, adjacent portions of the  
support posts and adjacent portions of the layer of fiber  
reinforced material.

27. A method for forming an end wall assembly comprising:

forming at least a portion of an end sill assembly and a top plate;

5 welding a first edge plate and a second edge plate with the top plate and the portion of end sill assembly to form an end wall frame assembly;

10 attaching a plurality of end beams with the first plate and the second edge plate by securing a first end of each end beam with a respective portion of the first edge plate and attaching a second end of each end beam with a respective portion of the second edge plate;

attaching metal sheets to an exterior of the end wall frame assembly;

15 cleaning interior surfaces of the metal sheets and the end wall frame assembly;

attaching isolators with the end beams opposite from the metal sheets;

20 attaching at least one layer of fiber reinforced material with the isolators to form an interior surface of the end wall assembly;

preheating the end wall assembly;

25 injecting liquid insulating foam into the end wall assembly between the metal sheets and the layer of fiber reinforced material; and

30 heating and pressing the liquid insulating foam to form solid foam insulation bonded with interior surfaces of the metal sheets, adjacent portions of the end beams and adjacent portions of the layer of fiber reinforced material.